ALBERTA HERITAGE FOUNDATION FOR MEDICAL RESEARCH

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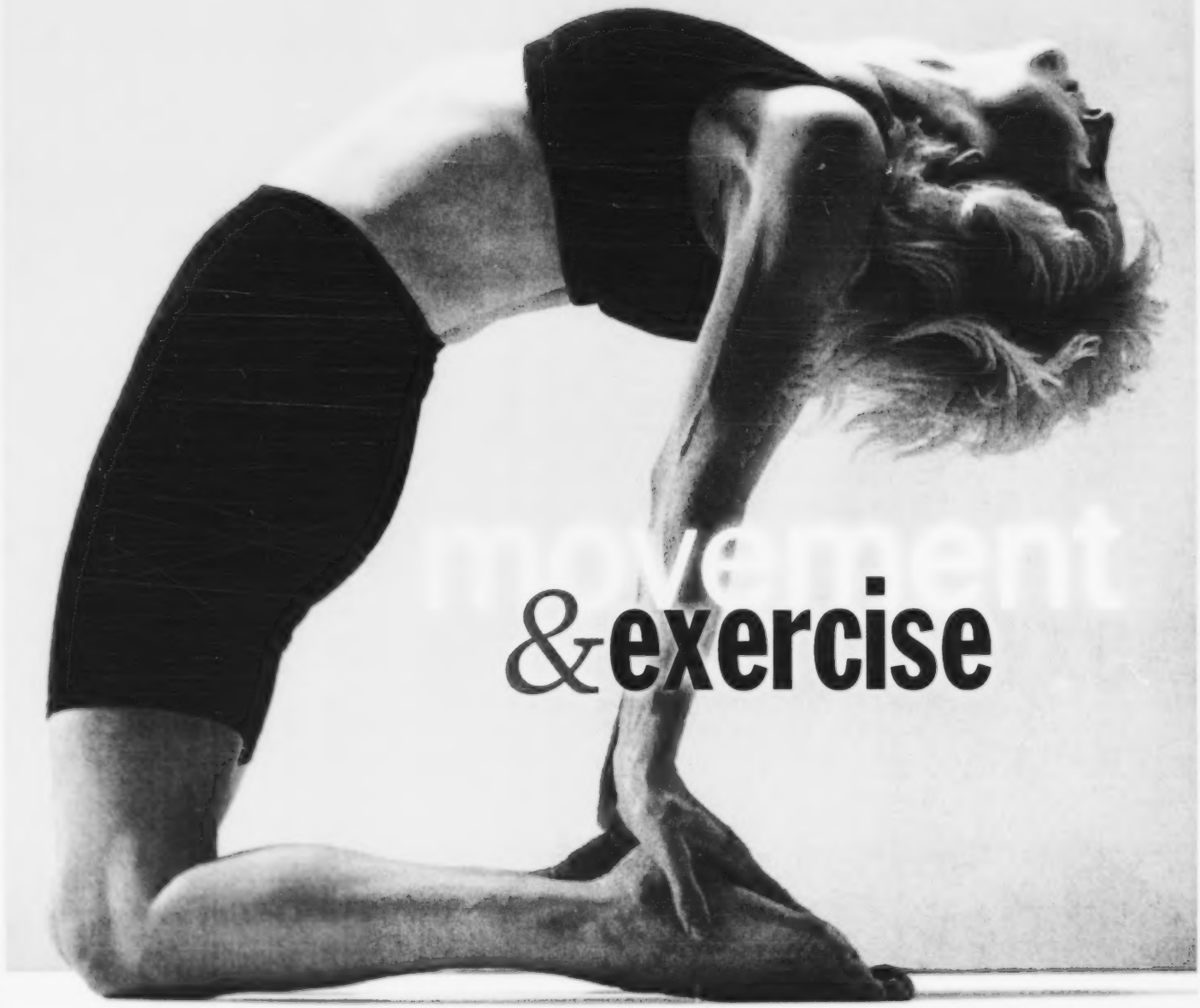
SUMMER 2000



movement & exercise

research news

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SUMMER 2000

6 Movement and exercise

Muscles are more than just for flexing. Heritage researchers are showing that exercise can have remarkable effects on physical and mental health, longevity, and quality of life.

Gathering medical information on the run

Read how an emergency physician's great idea for gathering vital information is on the road to commercial success.

14 Shades of grey

More than twice as many women as men are diagnosed with some form of depression. But what about women who don't respond to drug therapy? Heritage researcher Dr. Kathleen Hegadoren offers new knowledge on this widespread disease.

Looking through the "window of vulnerability"

Do you cringe at the thought of some of the things you did as a teen? Poised between childhood and adult responsibilities, some teens are vulnerable to behaviourial risks as they find their place in the world. Find out how Heritage research is trying to help vulnerable teens.

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AHFMR Mission

HFMR supports a community of esearchers who generate knowledge hat improves the health and quality of life f Albertans and people throughout the orld. AHFMR's long-term commitment is o fund basic, patient and health research ased on international standards of xcellence and carried out by new and stablished investigators and researchers n training.

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Production Notes

Managing Editor: Kathleen Thurber
Writers: Connie Bryson, Rhonda Lothammer, Kathleen Thurber
Design: Lara Minja, Lime Design Inc.
Illustrations: Cindy Revell, Eyewire
Front Cover: Trudie Lee
Photography: Roth & Ramberg, Trudie Lee Photography, Merle Robillard, University of Alberta Photo Services, University of Alberta Express News

The AHFMR Newsletter is published four times annually and is distributed free of charge to a controlled circulation list. If you wish to receive it, please contact us by phone, e-mail, fax or by letter.

AHFMR Research News is printed by Speedfast Color Press on 70lb Luna Matte text.

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ISBN: 1896956319

Canadian Publications Agreement #1602004

A World First in Diabetes Treatment

They're not brand spanking new or state-of-the-art. In fact, they're in the basement and don't even have windows. But the labs and offices of the principal researchers involved in developing the now-famous "Edmonton Protocol" diabetes treatment have a pedigree that seemed to foreshadow the phenomenal research success of its current occupants. Eighty years ago, this same basement area was the research laboratory of Dr. James Collip, a major Canadian scientific figure who made significant contributions to the discovery of insulin.

Dr. Jonathan Lakey and Dr. Greg Korbutt are proud of the Collip connection, but they attribute the 100% success rate of their new treatment to perseverance and vision rather than coincidence.

Both Heritage researchers were protégés of Dr. Raymond Rajotte, the Director of the Islet Cell Transplant Group and leader of the Edmonton Protocol research group. Dr. Korbutt, the Director of Quality Control for the Islet Cell Transplant Group, first worked with Dr. Rajotte as a NAIT graduate in biological sciences. Dr. Rajotte motivated him to first pursue his doctorate and then obtain specialized training in characterizing islet cells.

Dr. Lakey met Dr. Rajotte while he was finishing his master's degree in physiology. He completed his doctorate and post-doctoral fellowship with Dr. Rajotte and Dr. Garth Warnock before going to the Cryobiology Research Institute in Indianapolis for training in low-temperature biology. He is now the Director of the Human Islet Isolation Laboratory, which isolates the human islets for clinical transplantation.

Together with Dr. Rajotte and the other clinical and basic researchers on the team, the two scientists worked on refining the pioneering work in islet-cell transplantation done in 1989 by Dr. Rajotte, Dr. Warnock, and Dr. Norm Kneteman. Islet cells were transplanted into the diabetic patient's liver in the hope that the cells would take hold and produce insulin. However, the initial transplantations had only an 8% success rate. Within a few months, all the patients had to go back to injecting insulin.

So what made the group persevere with, in their own words, such a "dismal failure rate"? Dr. Lakey and Dr. Korbutt give credit to Dr. Rajotte's vision: "He knew the idea could work. But he also knew no one person could have the expertise needed for such a complex procedure. So he strategized for the future. He sent people all over the world to get specialized training. Then he brought them together and built a total team."

The total team approach worked because each member came in with new knowledge that led to a number of innovative changes in the transplantation procedure. The result revolutionized diabetes treatment.

By June 2000, a total of eight Alberta patients had received Edmonton Protocol transplants of islet cells. They were all severely diabetic, many of them suffering from "brittle diabetes", a form of the disease that causes unexpected and dangerous fluctuations in sugar levels. All eight patients have become insulin-independent—a first in world history—one of them for as long as 16 months.

What's in the future? More research, according to Drs. Korbutt and Lakey. "We know

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that the pancreas has a branching system of ducts that are precursors to islet cells. If we can take this tissue and grow islet cells, we could transplant two, maybe five or more people from one donor," says Dr. Lakey.

"Islet cells aren't just one type of cell, but a 'stew' of many cells. We now know exactly what we are putting in along with the islets, whether it's insulin-secreting cells or ductal cells," says Dr. Korbutt. "But we want to determine exactly how those cells are contributing to the production of insulin."

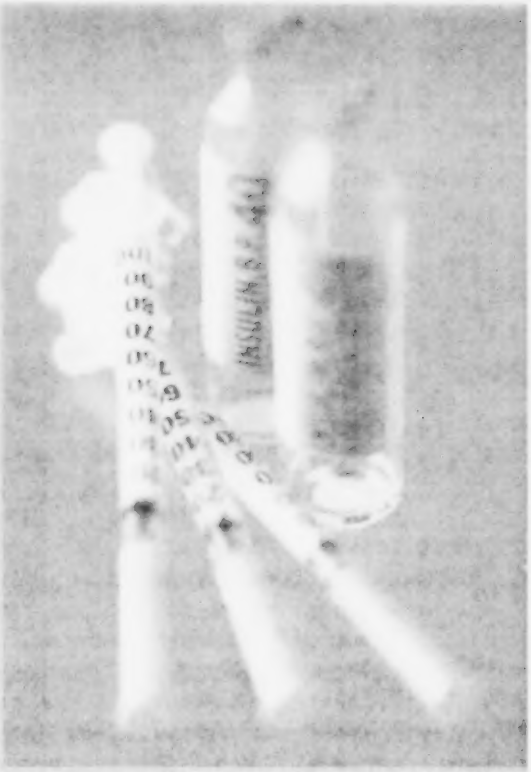
Public awareness of the prevalence and severity of diabetes is important too. Dr. Lakey points out: "This treatment means some Type I diabetics are free from insulin injections and from progression of the disease. But at this point it isn't for everyone with diabetes, and it isn't a cure."

Both researchers comment, "There are another 40 people waiting in Alberta who fit the criteria for transplantation. We receive hundreds of phone calls and e-mails a day from all over the world. The availability of organs is crucial. If everyone filled out their donor cards, we could help a significantly greater number of patients."

"Given that about 15% of healthcare dollars goes to treatment for diabetes and its complications, we want to see this therapy improved so that it can be offered to all types of diabetics."

Dr. Jonathan Lakey and Dr. Greg Korbutt are AHFMR Scholars, and Assistant Professors in the Faculty of Medicine at the University of Alberta. Dr. Korbutt also receives funding from the Canadian Diabetes Association; Dr. Lakey, from the Edmonton Civic Employees. Drs. Korbutt and Lakey receive support from the Canadian Institutes of Health Research, formerly the Medical Research Council of Canada, and the Juvenile Diabetes Association International. The funding for human trials was provided by the Alberta Foundation for Diabetic Research.

AHFMR has provided approximately $20 million in funding support for diabetic research at the University of Alberta over the past 20 years. Dr. Rajotte received some of the first funding from AHFMR in 1980. AHFMR currently funds or has funded nearly all the members of the Edmonton Protocol diabetes team.



The Clinical Islet Transplant team and affiliated researchers: Dr. Ray Rajotte, Dr. James Shapiro, Dr. Edmond Ryan, Dr. Jonathan Lakey, Dr. Greg Korbutt, Dr. Tim Kieffer, Dr. Alex Rabinovitch, Dr. Allan Murray, Dr. John Elliott, Dr. Chris Bleackley, Dr. Norm Kneteman, Dr. Garth Warnock, Dr. Ron Moore, as well as many students, post-doctoral fellows, and a dedicated group of technicians.

Diabetes Facts

Diabetes is a chronic, genetically determined, debilitating disease affecting many organ systems. It is the leading cause of kidney failure, adult blindness, and non-traumatic amputations, as well as a major cause of nerve damage. Life expectancy of people with Type I diabetes averages 15 years less than people without it. Life expectancy of people with Type II diabetes is shortened by 5 to 10 years. The disease is enormously costly to the healthcare system.

There are two major types of diabetes: Type I and Type II. Type I, previously called juvenile-onset diabetes, is caused by the autoimmune destruction of the insulin-producing cells in the pancreas and is usually, though not always, diagnosed in childhood. It is also known as insulin-dependent diabetes, for people with Type I diabetes must take insulin to live. People with Type II produce insulin, but their bodies do not use it effectively. Type II is usually diagnosed in adulthood, can be controlled with exercise, diet, and oral drugs, and does not always require insulin injections.

Courtesy of the University of Alberta, Faculty of Medicine

Sun and skin. We've known for quite a while that putting the two together can be a problem. Ultraviolet radiation from the sun is the primary factor in the development of the vast majority of skin cancers.

From suntan to skin cancer

What isn't clear, though, is the sequence of events leading from sun exposure to the development of a tumour. "If we understood exactly the molecular mechanisms of skin cancer, then we might be able to design novel ways to prevent and even cure skin cancer," says Dr. Victor Tron, Chair of the Department of Laboratory Medicine and Pathology at the University of Alberta.

Dr. Tron's research focuses on the genes involved in the development of skin cancer.

"Ultraviolet radiation damages our DNA by altering the bonds that hold DNA together," he explains. "But why is it that not everyone who is exposed to the sun gets skin cancer? We think it's due mainly to a protein called p53."

Called a tumour suppressor gene, p53 is responsible for the body's ability to recognize cells that have been exposed to too much ultraviolet radiation. It can direct the repair of DNA, or even get rid of damaged cells by killing them. But UV radiation can also damage the DNA in the gene that codes for p53. As a result, the p53 protein doesn't repair mutated cells as it should, and they end up dividing and propagating. A tumour is born.

"In our studies, we found mutated p53 in the very earliest stages of skin cancer," says Dr. Tron. "We're confident that p53 is controlling the process, but we don't yet know whether it does this directly or through a series of steps which involve other molecules.

"This is becoming a very tangled web, but that's the essence of science. The more answers you get, the more questions there are.

"I love the research. Honestly, it's just like Christmas when someone shows me an interesting result. It's that exciting."

Currently, Dr. Tron's research team is studying three molecules that depend on p53 to become active. This summer, three students (two of them funded by AHFMR) are exploring the regulation of the DNA repair process. It's possible that one of the molecules could become a target for a new therapy. For example, a topical cream could be developed that enhances the expression of a particular molecule. This would in turn enhance the process of DNA repair.

Dr. Tron notes that such a therapy would not be limited to the treatment of skin cancer. "We may also be able to treat photo-aging–damage done to the skin due to the direct effects of ultraviolet light," he says. "Some older patients tend to have leathery skin that often sags or droops. Wrinkles are another major cosmetic concern, and the cause of wrinkling can often be traced back to sun exposure. By and large, current treatments for wrinkles are not science-based."

However, don't expect "Dr. Tron's Anti-Wrinkle/Anti-Cancer Cream" to appear on drugstore shelves soon. "Our goal is to gain a firm understanding of how the body's ability to prevent skin cancer becomes compromised," explains Dr. Tron. "Only then will we be able to develop effective treatments."

Dr. Victor Tron holds an AHFMR Independent Establishment Grant and is Professor and Chair of the Department of Laboratory Medicine and Pathology at the University of Alberta. He also receives support from the Canadian Institutes of Health Research, formerly the Medical Research Council of Canada, and the National Cancer Institute of Canada.

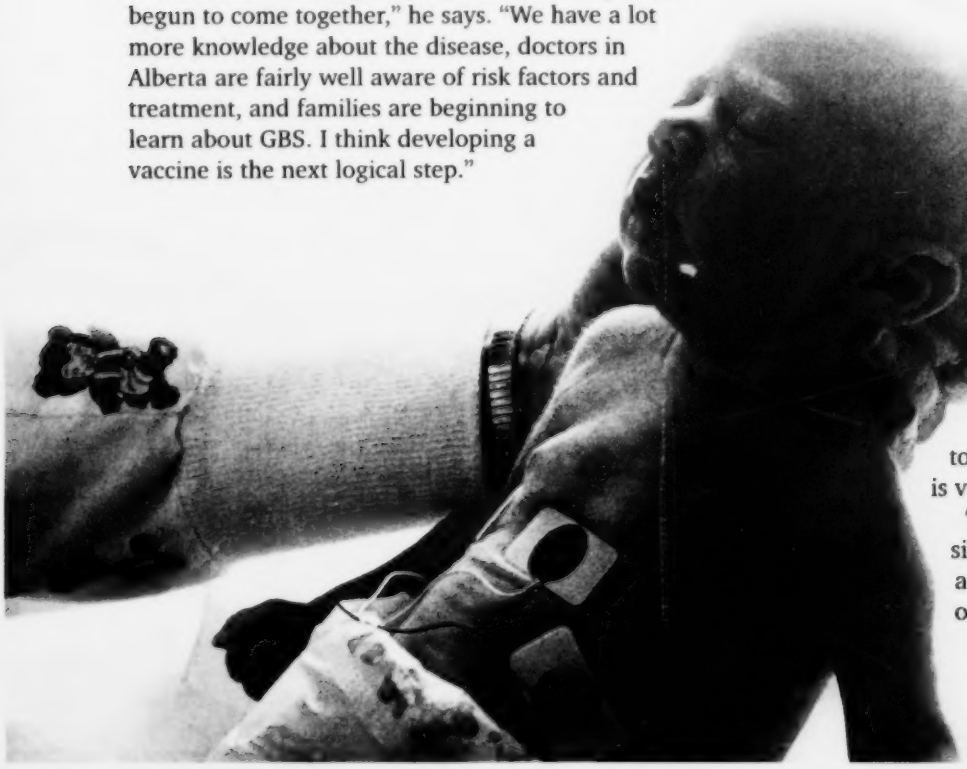
What you don't

Of all the worries that can consume expectant parents, Group B streptococcal (GBS) disease is not likely to even be on the list. It's a name that many parents will never hear. But some do ... usually within hours of birth, when their newborn child becomes critically ill. They're often shocked to learn that Group B strep is a leading cause of serious infection in newborns.

"It's absolutely devastating to carry a healthy baby through pregnancy and then have the little one become very, very sick within a few hours of birth and, in some cases, die," says Dr. Dele Davies, a Heritage researcher at the University of Calgary. "Group B strep is a very serious health issue."

Dr. Davies has become the research champion of GBS prevention in Alberta. His work on screening, laboratory testing methods, treatment guidelines, and risk factors has earned him a reputation as a world expert on GBS. Recently, he has begun to collaborate on the development of a vaccine.

"Over the last few years, my work on Strep B has begun to come together," he says. "We have a lot more knowledge about the disease, doctors in Alberta are fairly well aware of risk factors and treatment, and families are beginning to learn about GBS. I think developing a vaccine is the next logical step."



A GBS primer

Group B strep is a fairly common type of bacteria. It is not the same as Group A strep, which causes strep throat. GBS is found in many healthy adults, including 15–40% of healthy adult women. In a recent study of 1200 pregnant women in Alberta, Dr. Davies found the infection rate to be 19%.

Newborns contract GBS during labour and delivery, when they come into direct contact with the bacteria carried by their mother in the vagina or lower intestine. Fortunately, most babies who contract GBS from their mother do not get sick.

However, 1–3% of women infected will have babies who get the disease. The infants can develop blood, respiratory, and other devastating infections. As many as 10% of infected babies die from GBS disease, and as many as 20% are left permanently handicapped.

Group B strep is tricky, because a person who carries GBS is not sick and shows no symptoms. Consequently, screening is vital.

"Since there are no clinical signs of GBS, you can't tell who is a GBS carrier by taking a history or doing a physical exam,"

know
can hurt your newborn

explains Dr. Davies. "You need to actually culture the bacteria from a clinical sample."

Knowing the result before going into labour can protect a baby's life. Alberta doctors routinely screen pregnant women for GBS at 36 weeks. If the test is positive, the recommendation is to give the mother antibiotics such as penicillin during labour. This will effectively prevent most GBS infection in newborns.

Understanding why some babies develop GBS disease while others do not was one of the objectives of a recently completed study by Dr. Davies' research group. More than 500 women in Alberta were enrolled in the study, which identified such key risk factors as prolonged rupture of membranes, fever during pregnancy, premature delivery, prior delivery of an infant with GBS disease, and quality of care during pregnancy.

"What we see from these data is that GBS disease is multifactorial and highly complex," says Dr. Davies.

"Antibiotics are a short-term solution. Eventually we will run into problems with resistance. I'm convinced that vaccination is the best long-term solution because it will eradicate this serious threat to children's health."

Developing a vaccine

The conventional approach to developing a vaccine that protects against this type of bacteria is to base the vaccine on sugar molecules called polysaccharides. Adding a protein to the polysaccharide molecule enhances the production of antibodies needed to combat the disorder. This is called a conjugate vaccine. The HiB (Haemophilus influenzae type B) vaccine is an example of a conjugate vaccine.

But HiB has only one strain (the technical name is serotype); Strep B has at least eight. "You'd have to conjugate each one, and that would make the vaccine very expensive," notes Dr. Davies. "An alternative approach is to develop a protein vaccine. That's the route we've chosen."

Dr. Davies is collaborating with Dr. Bernard Brodeur's research team from Université Laval. They have identified a protein common to all serotypes of Group B strep, which could become the basis of a protein vaccine.

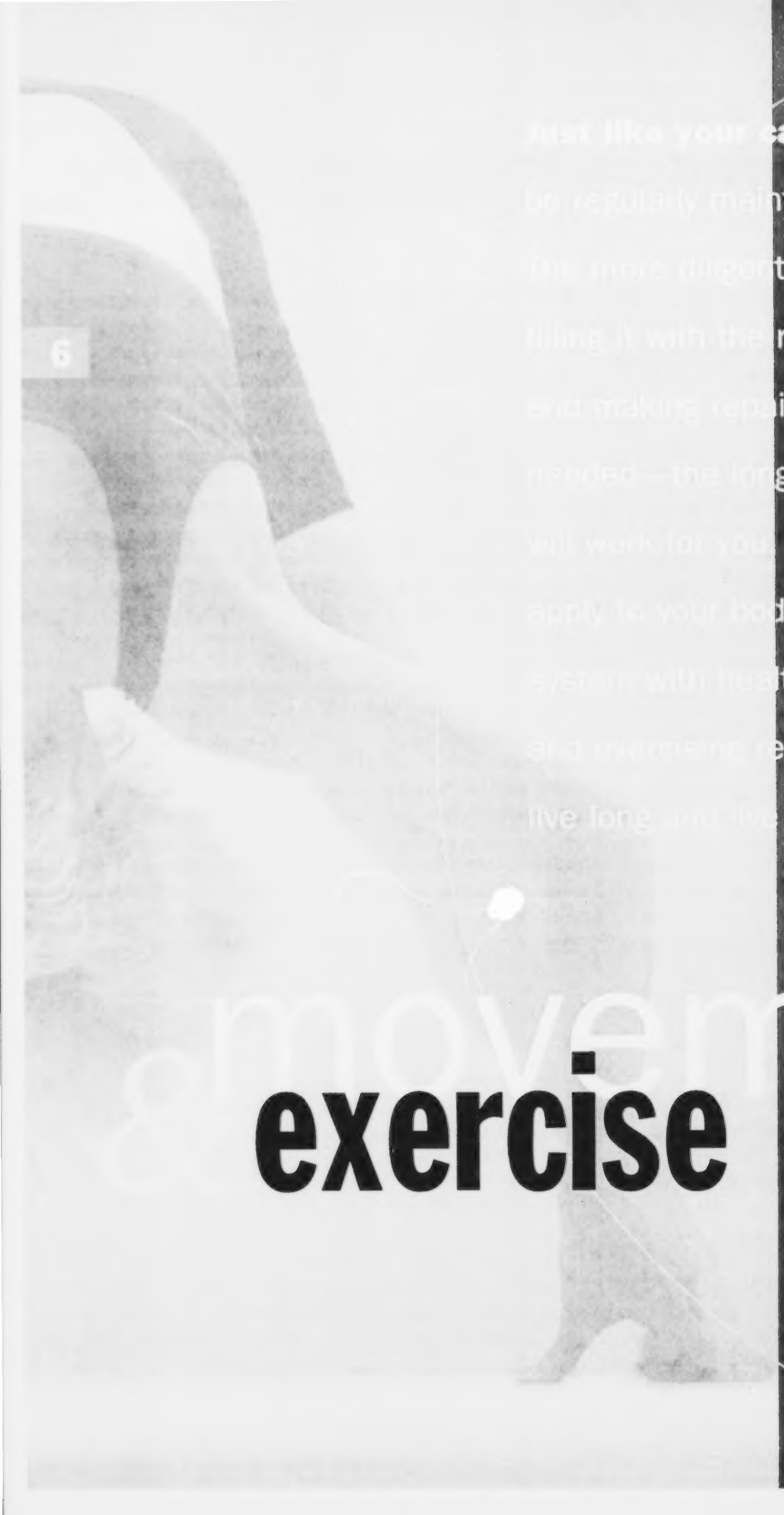
While the Québec group works on vaccine development, Dr. Davies and his team are using clinical studies to gain more information about GBS itself, and are getting important background information on the potential effectiveness of the new protein as a vaccine.

They have found that of the eight GBS serotypes, three are common in Alberta. As well, some strains are more virulent than others, and women tend not to have antibodies against these virulent strains.

"There's much work to be done before we even have a vaccine to test. The research is only in the very early stages," notes Dr. Davies. "And even if we do develop the perfect vaccine, there will still be questions to answer about the best time to give the vaccine, and whether it could be given to pregnant women.

"Nonetheless, my eyes are fixed on prevention. I get excited about the possibility of never seeing another newborn infected with Strep B. That would be something to celebrate."

Dr. Davies is a Heritage Health Scholar, a University of Calgary Associate Professor, and Director of the Child Health Research Unit at the Alberta Children's Hospital. He also receives funding from the Canadian Institutes of Health Research, formerly the Medical Research Council of Canada, the National Health Research and Development Program, and the Alberta Children's Hospital Foundation.



Just like your car, your body must be regularly maintained to run well. The more diligently you look after it—filling it with the right kind of gas and making repairs when they're needed—the longer and better it will work for you. The same principles apply to your body. Fuelling your system with healthy, nutritious food and movement regularly will help you live long and live well.

exercise

movement

We all know that the benefits of exercise are many. Physical activity helps strengthen bones and muscles, resulting in less stress on your joints and helping you maintain good posture and balance. It lowers your blood pressure, keeps your heart healthy, and helps slow the effects of aging. Regular exercise can also boost your mental health by reducing anxiety and stress and helping you relax.

The natural effects of aging on your body's joints, bones, and muscles can hamper your ability to move without effort. You may gain weight as unused muscle turns to fat; you may find your reflexes are slower, your joints stiffer. With regular exercise, though, you can improve these impediments to movement. One U.S. study of sedentary elderly people with chronic health problems illustrates this point. Researchers put the 80- to 90-year-olds through a monitored weight-training program. Testing after several weeks of these exercises revealed that the once-frail seniors had increased their muscle strength by an astounding average of 180 percent. Their added strength allowed them to move better, and some were even able to walk without their canes. When they stopped exercising, their health and strength declined.

Heritage researchers in Calgary and Edmonton are investigating the benefits of exercise in treating a diverse group of health problems. They are examining the role exercise may play in improving the quality of life and chances for recovery of people with diseases or conditions such as cancer and fibromyalgia. Other Alberta scientists are looking at the link between movement and aging in the areas of disc degeneration, joint injury, and arthritis.

Pushing the limit

At the University of Alberta, Dr. Ming Chan is studying the way motor units work and how exercise might keep them in good working order. Motor units are the basic building blocks in the muscle. The Heritage researcher hopes to gain a better understanding of how they perform under stress by studying them in patients who have had polio. The poliovirus attacks the nervous system, killing motor nerve cells and causing decreased muscle strength and even paralysis. Motor nerve cells normally send signals to the muscles to make them move. "We don't know why, decades after they recover from polio, post-polio patients mysteriously lose strength in their muscles, including ones that were originally unaffected by polio," Dr. Chan says. One theory suggests that exercising may push the remaining nerve cells beyond their limit. Dr. Chan is working to define where this limit lies by directly measuring the number and function of surviving motor units.

He is also studying muscle function in aging. "We know that as we age, we lose muscle strength. We also know that we can gain some of that loss back through exercise," he explains. "What we don't know is why, although we may gain increased muscle strength, our muscle fatigue may also increase." Muscle fatigue could have particularly serious consequences for the elderly. "In certain cases, an elderly person who has exercised may be strong enough to walk down the street for a block or two, but once his or her muscles get tired, the person could fall down and fracture his or her hip," he says. The impact of strength-training exercise on muscle fatigue is being studied in Dr. Chan's lab.

Treating the treated

The rigorous nature of cancer treatment can take a harsh physical toll on patients. Dr. Kerry Courneya is conducting an innovative project looking at whether exercise can improve the way patients feel during cancer treatment and help them to recover more quickly from it. An initial project, in collaboration with cancer epidemiologist Dr. Christine Friedenrich of the Alberta Cancer Board of Calgary, found that there were very few studies on the subject. Their conclusions led Dr. Courneya to his current project: "We want to look at whether it is even feasible for cancer patients to exercise during treatment," he comments. "About 75% of the participants in

our study are going through chemotherapy and/or radiotherapy. We want to see if early intervention helps people cope with treatment better, rather than waiting until after treatment to rehabilitate."

DR. MICHELE CRITES BATTIE (L) AND DR. TAPIO VIDEMAN

Improving physical and mental health

People with fibromyalgia (FM) often experience pain so severe they are unable to perform common tasks. "Most people with FM are sedentary, show decreased endurance and strength, and have poor fitness levels due to limited physical activity. Adding exercise to their daily routines seems to increase their feeling of well-being, improves their pain tolerance, and reduces anxiety and tension," explains physiotherapist Dr. Jean Wessel. Dr. Wessel, along with Dr. Yagesh Bhambhani and doctoral student Sharla King, recently looked at the effects of an education program, an exercise program, and a combination program of education and exercise on volunteers who have FM.

Dr. Bhambhani is also investigating the role exercise may play in helping people with moderate to severe brain injury, known as traumatic brain injury (TBI), improve their physical and mental health. TBI patients often experience fatigue and an inability to carry out simple tasks of daily living, such as carrying the groceries or shovelling the walk. "Their improved fitness level should have other transferable effects," Dr. Bhambhani surmises. During the conditioning phase patients will train three times a week, using weights and an exercise bike to improve their fitness levels. The focus will be on aerobic fitness, which is known to improve both physical and mental health. "Hopefully, many of the patients will become more independent, possibly going back to work, and becoming less reliant on their caregivers," he says.

Tracing the source of back pain

Back pain can be one of the most painful conditions people experience. Most of us will suffer some form of it in our lifetime. Although the exact cause is often unknown, there are numerous treatments available, such as ergonomic improvements in the work place and programs that aim to prevent spinal disorders. Nonetheless, back pain is still one of the most common reasons for missed workdays and disability pensions for people in their prime work years.

Dr. Tapio Videman and Dr. Michele Crites Battié study the breakdown of the discs between the bones in the spine. Disc degeneration is suspected to be the primary source of severe back pain. When they embarked on their current research project, the two Heritage-supported researchers theorized that what was thought to cause disc degeneration might not be the major cause at all. They are analyzing spine MRI data to help them distinguish between degeneration caused by aging and other risk factors that may cause back-pain symptoms.

Drs. Crites Battié and Videman have studied identical twins in Finland to determine the relative effects of suspected risk factors on disc degeneration and back pain. They conducted intensive interviews with each twin to determine factors in their upbringing and lifestyle that might have contributed to degeneration. Some of the twins had very different exposures to particular risk factors for back pain. For instance, one twin might have spent most of his work life as a manual laborer, while the other worked at an office job. Because the twins are genetically identical and share practically the same childhood environment, the researchers were able to use MRI images to pick up differences in disc degeneration between the siblings and relate them to differences in adulthood exposures. They expected to find clear differences in disc degeneration.

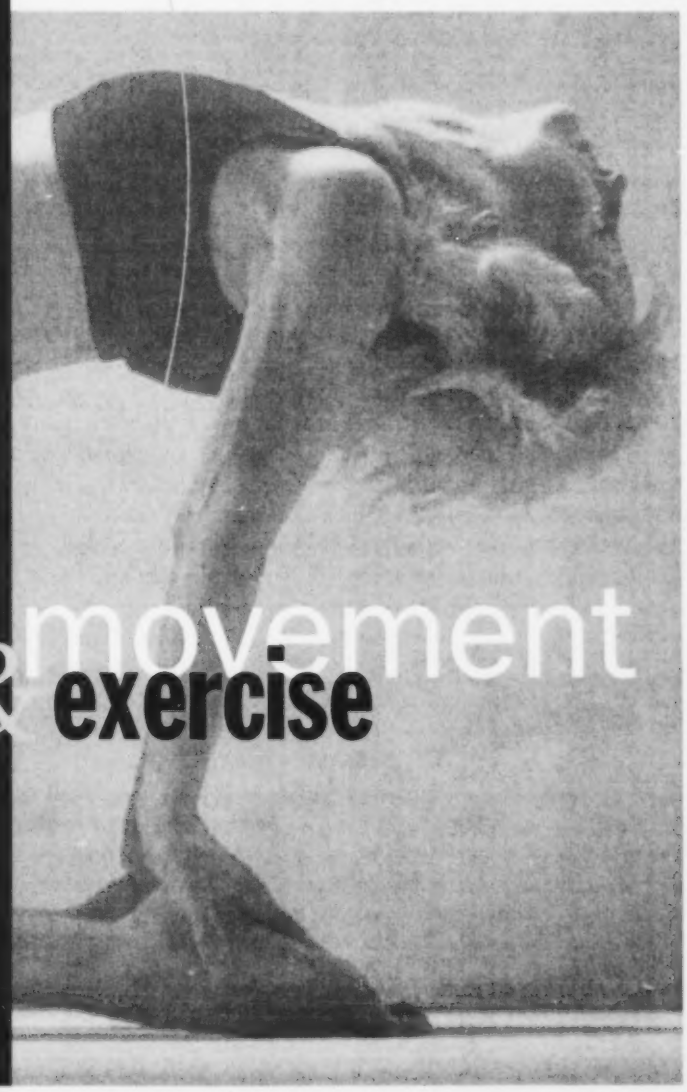
However, comparison of the results of the MRIs and the interviews revealed some startling results. Such suspected risk factors as heavy lifting and driving actually had much less effect on disc degeneration than previously thought. Instead, the results indicated that some combination of early upbringing and genetic history accounted for about half of disc degeneration in the twins studied. The researchers have identified two gene forms, which explained approximately 10% of disc degeneration; however, a significant part still remains unexplained. They underline that it is not yet clear how large a role the disc plays in painful spinal disorders, but it is still the main target of diagnostic tests and surgical interventions.

These findings explain, in part, why many preventative programs and all the wonders of modern medicine have failed to control disc degeneration and back pain.

Lessening pain symptoms

Joints have nerves associated with them that help our bodies detect pain. There is some evidence that these nerves are involved in co-ordinating muscle reflexes that protect joints from damage during normal activity. A loss of this ability may cause arthritis, reports Dr. Paul Salo. He studies aging in mice, and he has found that as mice get older, they spontaneously lose much of the nerve supply to their joints. In most cases this is associated with the development of arthritis. "Somehow, there is a connection between the loss of the nerve supply and arthritis in these animals," the Heritage researcher says. "If we can figure out how this happens, we might be able to prevent some forms of arthritis." While this area of research holds promise, scientists still can't firmly link the process to humans.

Aging may be a risk factor for arthritis, but other factors, such as obesity, may also put you at risk for the condition. Exercising keeps your joints flexible, improves muscle strength, and can decrease the pain caused by arthritis. Molecular biologist Dr. Tim Heslip is using what he has learned about the genetic material of the tiny Drosophila fruit fly to identify similar genes involved in the progression of arthritis and joint injury in humans. In particular, he is interested in how the fly uses genetic means to re-grow a limb in order to repair joint injury. "It really makes sense that, rather than using an entirely new process to fix an injury, animals would use part of their original developmental process which created the limb in the first place," Dr. Heslip notes. The ultimate goal of his research is to develop techniques of molecular biology, such as gene therapy, to treat arthritis and joint injury. in page 10 ▸



movement & exercise

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Dr. K. Ming Chan is a Heritage Clinical Investigator and an Assistant Professor in the Division of Neuroscience and the Division of Physical Medicine in the Faculty of Medicine and Dentistry.

Dr. Kerry Courneya received a major equipment grant from AHFMR and also receives support from the Health Research Fund administered by AHFMR for Alberta Health and Wellness. He is in the University of Alberta's Faculty of Kinesiology. His project is co-funded by the National Cancer Institute of Canada.

Dr. Yagesh Bhambhani receives support for his study from the Health Research Fund administered by AHFMR for Alberta Health and Wellness. He is also a co-investigator on a team that received support from the Alberta Paraplegic Foundation. Dr. Bhambhani works in the Department of Occupational Therapy in the University of Alberta's Faculty of Rehabilitation Medicine.

Dr. Jean Wessel was funded through the Health Research Fund administered by AHFMR for Alberta Health and Wellness.

Dr. Tapio Videman is a Heritage Senior Scholar with the Rehabilitation Medicine Faculty at the University of Alberta. He also receives funding from the National Institutes of Health.

Dr. Michele Crites Battié holds an Establishment Grant from AHFMR. She is also the Chair of the Department of Physical Therapy in the Rehabilitation Medicine Faculty at the University of Alberta.

Dr. Tim Heslip is a Heritage Scholar and Assistant Professor in the Department of Biochemistry and Molecular Biology in the Faculty of Medicine at the University of Calgary. He is also a member of the Joint Injury and Arthritis Research Group. Dr. Heslip receives additional support from the Canadian Institutes of Health Research, formerly the Medical Research Council of Canada.

Dr. Paul Salo is a Heritage Clinical Investigator and Assistant Professor in the Department of Surgery in the Faculty of Medicine at the University of Calgary.

Vital Con

The peripheral nervous system is made up of cell bodies housed in the back of the spine or in the brain stem, from which bundles of fibres, like telephone wires, stretch out to all parts of the body to pick up or deliver information. PNS nerves are made up of two types of nerve fibres bundled together in pairs. Sensory fibres pick up feeling and sensation and carry the messages back to the brain: motor fibres carry messages from the brain to muscle cells to help us move.

When peripheral nerve fibres are damaged by a disease such as diabetes, or by unknown causes, the result is a neuropathy, a loss of sensation or movement in parts of the body. Neuropathies can be part of the progression of a disease or, in other situations, recovery does occur but the pace and extent of it has a profound effect on quality of life.

Dr. Manuel Hulliger investigates the role of sensory feedback from muscles, limbs, and other body

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Dr. Paul Salo is a Heritage Clinical Investigator and Assistant Professor in the Department of Surgery in the Faculty of Medicine at the University of Calgary.

Vital Con

Injuries to the brain and spinal cord—the central nervous system (CNS)—are devastating and often irreparable: a famous recent example being actor Christopher Reeve, who was paralyzed after breaking his neck. Yet a large number of injuries seen in neurology clinics are those to the extensive network of nerves outside, or on the periphery, of the CNS. This peripheral nervous system (PNS) links the brain and spinal cord to the rest of the body.

The peripheral nervous system is made up of cell bodies housed in the back of the spine or in the brain stem, from which bundles of fibres, like telephone wires, stretch out to all parts of the body to pick up or deliver information. PNS nerves are made up of two types of nerve fibres bundled together in pairs. Sensory fibres pick up feeling and sensation and carry the messages back to the brain: motor fibres carry messages from the brain to muscle cells to help us move.

When peripheral nerve fibres are damaged by a disease such as diabetes, or by unknown causes, the result is a neuropathy, a loss of sensation or movement in parts of the body. Neuropathies can be part of the progression of a disease or, in other situations, recovery does occur but the pace and extent of it has a profound effect on quality of life.

Dr. Manuel Hulliger investigates the role of sensory feedback from muscles, limbs, and other body

nections

parts that control movement. His interest in neuropathies as a model to study sensory feedback in particular was sparked by reading Oliver Sacks' book *The Man Who Mistook His Wife for a Hat*. One of the stories in the book chronicled a woman who reported not only a loss of sensation in her hands and feet, but a loss of sense of body, position, and orientation. Although the cause of her sensory loss was not explained, it made Dr. Hulliger think about similar reports from the mid-1980s. At that time, many there were many cases of people who lost feeling in limbs and experienced disorientation after taking megadoses of Vitamin B6 in the belief it would alleviate pre-menstrual syndrome.

"Treatment is very simple: you get people off the drugs. However, the actual motor deficits—the long-lasting effects on motor nerves—had never been examined in detail," says Dr. Hulliger. Intrigued by the research possibilities, he began experimenting with Vitamin B6 in the lab as a way of suddenly inducing neuropathies non-surgically. With sudden neuropathies he studies the interruption of sensory feedback from muscles the moment it occurs and charts the effects on body movement during recovery.

What he found surprised him. "We always thought damage to sensory nerve fibres doesn't affect movement on a dramatic scale because the motor nerves and the central motor programs are still intact. We found that if a certain type of sensory nerves are affected—the large sensory afferent nerve fibres—it affects the sense of position and the sense of force in muscles, meaning that muscles are still working and strong but they can't work together, so the patient experiences a loss of coordination."

There was one other surprise. "We also found that recovery that appears normal does occur, but it happens without repair to the damaged sensory nerves; they are irreparable. Recovery is happening by plastic compensation; that is. by the remaining nerves and their connections in the brain compensating for the damaged ones."

Two sources of information help people recover from an injury such as a stroke. The first is visual. Patients have been noted watching the part of the body that is paralyzed. The second is through residual sensory efforts—the information conveyed from skin, joints, and muscles when patients try to move. Dr. Hulliger's experiments show that this kind of sensory information is used much more intensely after sensory nerve injury where there is some nerve use left. This may be key to reorganizing the circuitry in the sensory motor system to help compensate for nerve injury.

Dr. Hulliger thinks that therapies could be developed to capitalize on this innate ability to use sensory information more intensely and speed up healing. "For people who are recovering from stroke that would make a big difference because speed means a better quality of life faster."

Dr. Manuel Hulliger is an AHFMR Scientist and Professor in the Faculty of Medicine's Departments of Clinical Neurosciences, and Physiology & Biophysics at the University of Calgary. He also receives support from the Canadian Institutes of Health Research, formerly the Medical Research Council of Canada, and the National Institutes of Health.

If you're being rushed to hospital in an ambulance, chances are the last thing you'll be thinking about is how information about you is being recorded. But this information can be crucial—to facilitating treatment in the emergency department, to improving ambulance service, and to designing programs that could prevent certain injuries and diseases.

Gathering medical information **on the run**

Today, most paramedics and emergency medical technicians (EMTs) record patient information by filling out a lengthy form. The process takes time, handwriting can make the reports difficult to read, and the level of detail used by different people varies considerably. Emergency-department staff often spend time collecting information that the ambulance crew has already gathered.

As a result, the paper-based system is far from ideal. It's very difficult to do data analysis to determine trends in the injuries and illnesses that are bringing the patients to the hospital. And a comprehensive picture of the performance of the emergency medical system, based on hard data, is almost impossible to obtain.

This is changing, however, with the advent of computer programs that help ambulance crews enter patient information directly into a computer. One of the most advanced systems is made in Edmonton by ROAM I.T. Corporation. Its RAMPART-EMS™ software makes the entry, analysis, and reporting of patient-care data easy, accurate, consistent, and efficient.

Once the patient is stable, information is entered on a laptop computer. If time permits, this is done in the ambulance or on the scene; if there's no time on the road, the data is entered at the hospital. The RAMPART-EMS system uses different screens and pull-down menus to prompt the user for such information as the names of paramedics and EMTs on the unit, a description of the scene, patient condition and history, and treatments and medications delivered.

"The heart of our system is an extensive database that includes all the procedures done by ambulance crews, over 4000 medications, and a host of other information," says Lloyd Osler, President of ROAM I.T. "Only about 5% to 15% of the report is actually typed in. This is a substantial time-saving and makes data consistent from one report to another.

"Once the information is entered, the software abstracts it and produces a narrative report. It reads very well. You can see at a glance what has happened."

MIKE LOWING, DEPUTY FIRE CHIEF, YELLOWKNIFE FIRE DEPARTMENT

A bright idea

RAMPART-EMS is the brainchild of Dr. Louis Francescutti, an emergency-room physician at the Royal Alexandra Hospital and injury researcher at the University of Alberta.

"Louis' concept was to capture data at the injury site, when the information is fresh, instead of waiting until after the patient is in the hospital," explains Mr. Osler. "He knew that the only way to do this would be to make it easy to fill out reports in the field."

"Once you have accurate information, you can put it into a database and start looking for patterns of diseases or injuries. With this kind of information, you can begin to develop prevention programs that target particular diseases or injuries."

In 1996, Dr. Francescutti and graduate student Trevor Strome began developing the software. Their work came to the attention of Mr. Osler and his partner in OVIS Incorporated, an information systems company.

"Our company has a great deal of experience with electronic libraries and knowledge-based systems. We saw a synergy with the RAMPART-EMS software and a terrific opportunity," says Mr. Osler. ROAM I.T. was formed in 1998 as a partnership between OVIS, RDM Incorporated (a medical informatics research group), Access Medical Inc. (a distributor of medical equipment), and the University of Alberta.

"At the time ROAM I.T. was established, there was a prototype but we didn't have a product," explains Mr. Osler. "So we spent a lot of time developing the system's database and user interface to make it a marketable product."

Part of the funding for this work came from AHFMR's Technology Commercialization Program. "Support from AHFMR was critical in the early days of ROAM I.T. to get the company off the ground," continues Mr. Osler.

Commercial success

In 1999, ROAM I.T. made its first sale of the RAMPART-EMS system to the ambulance service run by the Yellowknife Fire Department. The software is installed on a computer in Yellowknife's Stanton Hospital. Crews from the service's three ambulances file all their reports there.

"When we stopped using paper and started using RAMPART-EMS, the first thing we noticed was that the quality of our reports went through the roof," says Mike Lowing, Deputy Fire Chief with the Yellowknife Fire Department. "Now, our patient reports are detailed and consistent. The improvement has caused a ripple effect. Emergency-room staff have much better patient reports, so they don't have to duplicate information gathering. The Stanton Hospital also has trip data that were never collected before. We can really see how the service is operating and which areas need attention.

"I think the software has also sparked a cultural change. Our paramedics and EMTs see that the information they're collecting is actually being used, not falling into some black hole. That's a morale boost."

Gearing up for sales

Enthusiastic testimonials like Mr. Lowing's are what ROAM I.T. is counting on as marketing efforts gear up. The company's target markets for RAMPART-EMS are ambulance services, the occupational health and safety departments of large companies, and the military. ROAM I.T. estimates the value of the North American market for data-management systems like RAMPART-EMS to be over $1 billion.

To date, sales of RAMPART-EMS have involved software only. The next generation of the product will be a turnkey mobile system complete with hardware and software.

"None of our competitors are doing this," notes Mr. Osler. "We'll have a tremendous edge in the marketplace."

Scaling up a young company is an expensive business, however, and new investment is needed to fund marketing support and ongoing R & D programs. Attracting investment capital is another one of senior management's current tasks.

"Whenever I feel a bit stressed, I need to get out on the street with a potential client and show them the system," says Mr. Osler. "When they see what RAMPART-EMS can do, without exception everyone says 'I want that.' That's the kind of response that energizes me."

Shades of Grey

Some call it the invisible disease, but its toll is visible in the lives it affects: children, spouses, parents, and friends who struggle to cope with an affected loved one. Depression is a serious health condition that the World Health Organization predicts will rank second in terms of a global burden of disease within a decade. Overwhelmingly women—more than twice as many as men—are diagnosed with depression.

Passionate about improving the mental health of women, Heritage researcher Dr. Kathleen Hegadoren makes frequent presentations throughout the community about her work on depression, recruiting many of her subjects from public lectures and through word of mouth. The response is not only indicative of the need for extensive research in the field, but is particularly gratifying. "I had an elderly woman phone me from Calgary. Her daughter had struggled with depression. The mother was so happy to hear of my research she offered to come and wash dishes in my lab."

Trained as a nurse, Dr. Hegadoren worked in child and adolescent psychiatry, where she became "insatiably curious" about the brain and how it works. She went on to pursue a doctorate in neuropsychopharmacology (drugs that affect the brain) and neurobiology. She recalls looking at the effects of progesterone, a female sex hormone, on specific nerve cells and thinking, "If you can show that on a cellular level, I wonder what this means to a woman?" This reflection on the action of female sex hormones on drug response became an underlying theme in her future research.

The effects of abuse

The other area of study for Dr. Hegadoren is the effects of interpersonal trauma—sexual, physical, as well as the difficult-to-quantify emotional abuse—on depressed women. In her clinical work, she observed that women who had poor response to antidepressant therapy often had experienced traumatic life events in their past. Yet, for the most part, these events were not assessed as part of the patients' psychiatric evaluations, perhaps because they happened prior to depression and were viewed as not being a direct cause of the adult depression.

Dr. Hegadoren proposes that for many of these women, depression is nested within a post-traumatic syndrome related to earlier traumatic life events. This results in more complex mental-health problems and long-term biological changes. Dr. Hegadoren found that these women showed more than the typical changes seen in depression; the changes in their stress-hormone systems were similar to those of combat veterans with post-traumatic stress disorder.

"It might be that the reason the women did not respond well to antidepressant drugs is because we weren't treating the whole person," she says. "Antidepressants can only do so much; there have to be other, very targeted kinds of psychological and psychosocial interventions to cope with their anxiety and chronic stress. In fact, we might have been setting them up for more despair: These women viewed their failure to respond to treatment as one more failure in their lives."

Dr. Hegadoren recently established a laboratory in the Faculty of Nursing—the first of its kind in Canada

dedicated to women's health studies. She works in collaboration with fellow Heritage researchers and psychiatrists Dr. Nick Coupland and Dr. Jean-Michel Le Melledo, both of whom investigate aspects of anxiety disorders and the impact of female hormones on psychiatric symptoms. Her goal is to use the stress-hormone system as a way to differentiate between types of depression, predict response to antidepressant therapy, and develop treatments that address the impact of traumatic events.

Using stress to determine stress

In one of her studies, after assessing her subjects' histories, Dr. Hegadoren gives them a synthetic stress hormone to stimulate the stress-hormone system. Then she follows its effects in the body by blood analysis. Existing research shows that when this is done with someone who is depressed, there is a blunted response. Dr. Hegadoren hypothesizes that if the same synthetic hormone is given to a depressed person who has been affected by a history of trauma, there will be a very different response. Stress-hormone levels in the blood don't just drop: they plummet sharply. The heart beats faster. There is an exaggerated startle response. In such people, the stress-hormone system has become hypersensitive to stimulation. This might reflect a decrease in the capacity of the stress-hormone system to deal with stress. The resulting decreased adaptability could affect the woman's capacity, both biological and behavioural, to cope with day-to-day stress, increasing her vulnerability to chronic mental-health problems.

As further evidence of the impact of traumatic events on biological function, the women Dr. Hegadoren works with often complain of stomach problems, which might be related to high levels of adrenaline interfering with digestion. They also have a higher incidence of irritable bowel syndrome. Other common physical symptoms include sleep problems, memory difficulties, severe anxiety, and exaggerated startle response.

However, she points out, not all people with a history of traumatic events have been negatively affected by their experiences. In fact, some are very resilient. One of her other research interests is determining what coping mechanisms these women have that could be used by health professionals to develop resiliency-based programs.

The relief of validation

Many women are relieved to discover there is a scientific way to determine the difference between their stress-hormone levels and those of other people. "It validates them," says Dr. Hegadoren. "But it is also scary because it shows that they've been fundamentally changed over the long term by life events." As an analogy, she points out to subjects that diabetes is also a scary thing to have, but since it can have many effects on long-term health, it has to be managed on a daily basis. "In the same way, knowing that their bodies have a decreased ability to deal with stress can give people power, because they realize what events have done to them, and they can learn daily strategies to take care of their own mental health."

Dr. Hegadoren's research is continuing, and she welcomes inquiries from women who are depressed and who would like to participate in her studies. Please call (780) 492-5229 and leave a message.

Dr. Kathleen Hegadoren is an AHFMR Population Health Investigator who is an Assistant Professor in the Faculty of Nursing at the University of Alberta. She also receives funding from the Canadian Institutes of Health Research, formerly the Medical Research Council, and the Canada Foundation for Innovation.

Missing half

An important facet of Dr. Hegadoren's research is determining the differences between men's response to antidepressants and that of women. Since twice as many women as men are diagnosed with depression, most antidepressants are taken by women. However, clinical trials for many of the antidepressants did not use female test subjects in the early, developmental stages of the drugs. In fact, historically, by the time the first woman was given a drug in a trial, the drug would have been already close to market. Because of the complexity of female biology, clinical trials have traditionally included only women who are in the follicular phase—the first half—of their menstrual cycle, when estrogen and progesterone are low. Since estrogen and progesterone have profound and varied effects in the brain, and also on the levels of drug in the brain, both hormones can have a significant influence on the effectiveness of antidepressant medication in women. It is only in the recent past that federal agencies have started demanding female data for drugs that target women.

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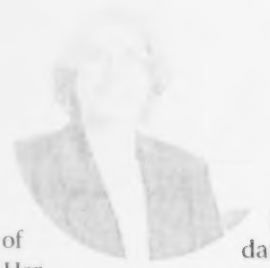

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A new use for an old drug

Taking a common drug normally used to treat acne might one day also help reduce damage caused by heart attacks. It is not the antibiotic effect but another chemical effect that tetracycline has on certain components in heart cells that Dr. Rick Schulz thinks may prevent injury to the organ.

The Heritage researcher and his University of Alberta colleagues* have found that the protective function of the antibiotic works not by fighting bacterial infections in the heart, but by inhibiting the action of enzymes called matrix metalloproteinases (MMPs). They think that MMPs, which are released by heart cells within seconds of the onset of a heart attack, damage heart tissue by dissolving the "glue" between cells that gives them their structure or by chewing up necessary cell proteins. This glue, the extracellular matrix, is made up of proteins that help keep the heart and other organs working normally. MMPs are dormant in cells waiting for a certain cellular signal. When they are activated by one of these signals, MMPs act as molecular scissors, cutting proteins into smaller bits, a process known as proteolysis.

Dr. Schulz has found that MMPs could be contributing to the inability of the heart to contract with its normal force in the minutes immediately following a heart attack. If the heart can't pump blood to the tissue with its normal force, then oxygen and vital nutrients can't be delivered as efficiently as they must be to all parts of the body, including the heart muscle.

MMPs are like a bobcat that is parked in a garage for safe keeping, the garage representing a heart cell. Opening the garage door and driving the bobcat out of the garage without crashing into anything is the way MMPs work in a healthy heart.

He describes the process like this: MMPs are like a bobcat that is parked in a garage for safe keeping, the garage representing a heart cell. Opening the garage door and driving the bobcat out of the garage without crashing into anything is the way MMPs work in a healthy heart. "But during a heart attack, it is like someone has turned on the bobcat even before the garage door has been opened, and it's running amok in the garage, crashing into things and making a terrible mess," Dr. Schulz explains. "This may be what is happening to some heart cells during a heart attack." Tetracycline drugs work by "turning off the bobcat's motor and stealing the key," he says.

These findings open up an entirely new avenue for understanding and possibly treating or preventing heart attacks. The team's work suggests an alternative to the theory that bacterial infections may cause heart disease. Corroborating this theory, a recent British report showed that people who happened to be on tetracycline antibiotics had a lower risk for first-time heart attacks than those who weren't taking this class of antibiotics.

*The research team includes Heritage researcher Dr. Marek Radomski, Dr. Po-Yin Cheung, Dr. Greg Sawicki, Dr. Mieczyslaw Wozniak, and Dr. Wenjie Wang.

Dr. Rick Schulz is a Heritage Senior Scholar and an Associate Professor in the departments of Pediatrics and Pharmacology in the Faculty of Medicine and Dentistry at the University of Alberta. He also receives funding from the Canadian Institutes of Health Research, formerly the Medical Research Council of Canada, and the Heart and Stroke Foundation of Alberta and the Northwest Territories. His team's results were published in a recent issue of Circulation, The Journal of the American Heart Association.

Foot pain, wallet gain

Many factors can contribute to the condition, including too much activity, lack of strength in the foot and ankle, and an improper shoe fit. Because the majority of people who develop plantar fasciitis are over 30, Dr. Wiley and other researchers hypothesize that degenerative changes within the tendons and ligaments may contribute to the condition.

Dr. Wiley and co-investigators Dr. Cam Donaldson, a Heritage researcher (Department of Community Health Sciences), and Dr. Rita Aggarwala (Department of Mathematics and Statistics), received funding last March to conduct a two-year research project comparing three common treatments for plantar fasciitis, to see which works best for patients and which is the most economical. "This type of problem is a big cost to the system," Dr. Wiley comments. "If we have a treatment that works well for the majority of patients and is available at a low cost, then the implications on the healthcare system would be significant."

Dr. Donaldson will help determine how much each treatment costs patients and the healthcare system. The health economist will take a comprehensive look at everything from the actual cost of the treatments to the amount of time a patient has to take off work to obtain them. "The healthcare system is interested in their effectiveness and what it costs to provide the service," Dr. Wiley explains. "The patient is more interested in quality-of-life issues, particularly how the treatment affects them and impacts their ability to work." The study will evaluate both of these concerns.

The research team will recruit about 100 people with plantar fasciitis who have not previously received treatment. To prevent bias, the treatments are not identified here, but they do not involve either pills or injections. They are standard treatments used by doctors, podiatrists, and other healthcare workers, Dr. Wiley says. Each patient will be tested for improvement at regular intervals over a 12-month period.

Most people with plantar fasciitis see an improvement in their condition after three to six months of treatment. Surgery is not usually required.

Dr. Preston Wiley receives support for his study from the Health Research Fund administered for Alberta Health and Wellness by the Alberta Heritage Foundation for Medical Research. Dr. Wiley receives additional support from Colman Prosthetics and Orthotics Ltd. and the University of Calgary Sport Medicine Centre.

Looking through the "window" Adoles

It's the age that strikes fear into every parent's heart. Adolescence ... the time of experimentation with new ideas, new friends, and unfortunately, new risk behaviours such as smoking, drinking, taking illicit drugs and having sex.

Today, a substantial minority of young people run very serious health risks. Canadian data show the major risk period for initiation into alcohol, tobacco, and most illegal drugs begins at around age 12 and is mostly finished by 22.

As a result, many health researchers call early adolescence the "window of vulnerability" for life-threatening health risks. By the ages of 16 to 18, this vulnerability is strongly established for those who emerged as vulnerable in early adolescent years.

But what makes a child vulnerable? That's one of the questions being investigated by a team of researchers from the University of Alberta, the Capital Health Authority, and the Alberta Alcohol and Drug Abuse Commission (AADAC). Their AHFMR-supported study is designed to collect key data on physical and emotional health risks for Alberta adolescents and relate them to the process of identity formation in young people.

"Our team is focused on practical outcomes," says Dr. Brenda Munro, a Professor in the Department of Human Ecology at the University of Alberta. "By understanding who is vulnerable and why they are vulnerable, we can move forward in designing programs that reach these children effectively."

DR. BRENDA MUNRO

"It's this emphasis that particularly interests AADAC," says Mr. Gord Munro, AADAC's Research and Special Projects Coordinator. "On a daily basis AADAC deals with adults who have serious addictions. We develop and implement programs to help them, but we've always wondered if we can't tackle these problems earlier. This study will help us understand the issues that are important in junior and senior high."

And do something about them, adds Dr. Maryanne Doherty, an Associate Professor in the Department of Secondary Education in the Faculty of Education at the University of Alberta.

"My interest is in curriculum development and teacher education," she says. "We know students have fairly detailed knowledge about health risks, good attitudes and good intentions. But for many kids, something happens. What are the intervening variables? What can we do, as teachers, to help?"

The research involves two major questionnaires and personal interviews. The first questionnaire, administered to 2000 students in junior and senior high schools across Alberta in the fall of 1999, dealt with mental health issues. The second survey, completed in the spring of 2000, asked questions about education, eating, body image, addictive behaviour, and relationship with parents. The third component is a series of focus groups and one-on-one inter-

# of vulnerability"

cence

"Everyone on the research team is excited about the results and how to use them in our own areas," says Dr. Joy Edwards, a Public Health Research Scientist with the Capital Health Authority. "From the public health perspective, we'll have invaluable data about the health of our young people and key information that will help us design programs and policies aimed at reducing health risks.

"We'll be able to do things that really make a difference."

views with selected young people from various ethnic groups and risk categories.

One of the unique features of this study is its focus on identity and using identity to understand health behaviour choice. While identity formation begins in childhood, adolescence accelerates the process. It is a time of intense experimentation with roles, behaviours, and values. Through this process, adolescents arrive at an identity that includes certain health-related behaviours and mood states that may be hard to change, if necessary, later on.

The study is also designed to look at risk behaviours in ethnic groups. Identity development can be particularly complicated for adolescents belonging to ethnic groups. These young people are often caught between their parents' ethnic beliefs and values, and those of mainstream society.

Survey results are now being analyzed and the team hopes to have preliminary results by the fall of 2000.

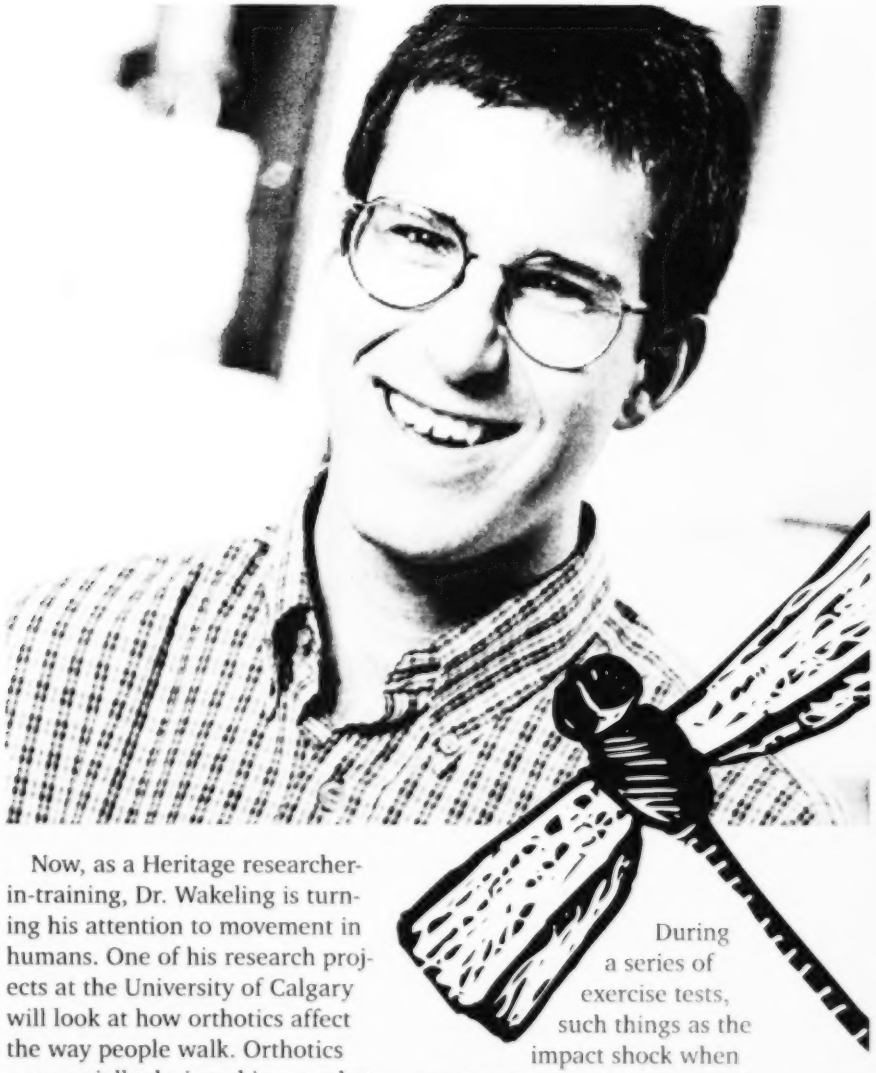
Details on the team:

Dr. Gerald Adams, University of Guelph
Dr. Maryanne Doherty, University of Alberta
Dr. Joy Edwards, Capital Health Authority
Dr. Brenda Munro, University of Alberta
Mr. Gord Munro, Alberta Alcohol and Drug Abuse Commission

Dr. Brenda Munro's project is supported by the Health Research Fund, administered by AHFMR on behalf of Alberta Health and Wellness.

DR. BRENDA MUNRO (CENTRE) WITH RESEARCH TEAM

If the shoe fits, wear it



Dr. James Wakeling has had a particular fascination with how living things move. His Ph.D. in Zoology from the University of Cambridge in the U.K. focused on the flight of the dragonfly. High-speed film allowed him to capture the insect's flight patterns in order to study how their bodies move and their muscles function.

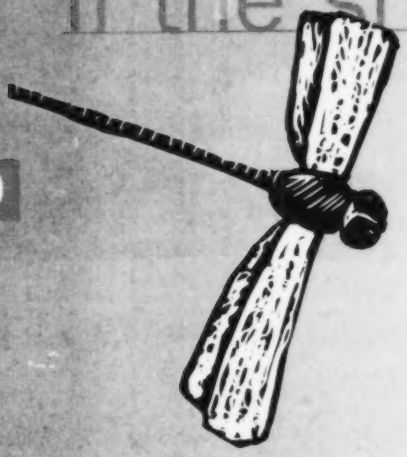
These studies led Dr. Wakeling from movement in the air to movement in the water, where he focused his interest on the intricacies of muscle function in fish as they swam. Put simply, a series of muscles on each side of the body contract in succession to whip the tail back and forth and propel the fish forward.

Now, as a Heritage researcher-in-training, Dr. Wakeling is turning his attention to movement in humans. One of his research projects at the University of Calgary will look at how orthotics affect the way people walk. Orthotics are specially designed inserts that are worn inside the shoe to help correct such foot problems as flat feet or heel spurs.

In the lab, study participants test different types of shoes where the shape and cushioning of the sole have been modified. During a series of exercise tests, such things as the impact shock when the foot touches the ground, the resulting leg vibrations, and the muscle activity are measured.

The way muscles are used during walking and running changes with each new shoe you wear, Dr. Wakeling explains. "Although we know that orthotics do benefit

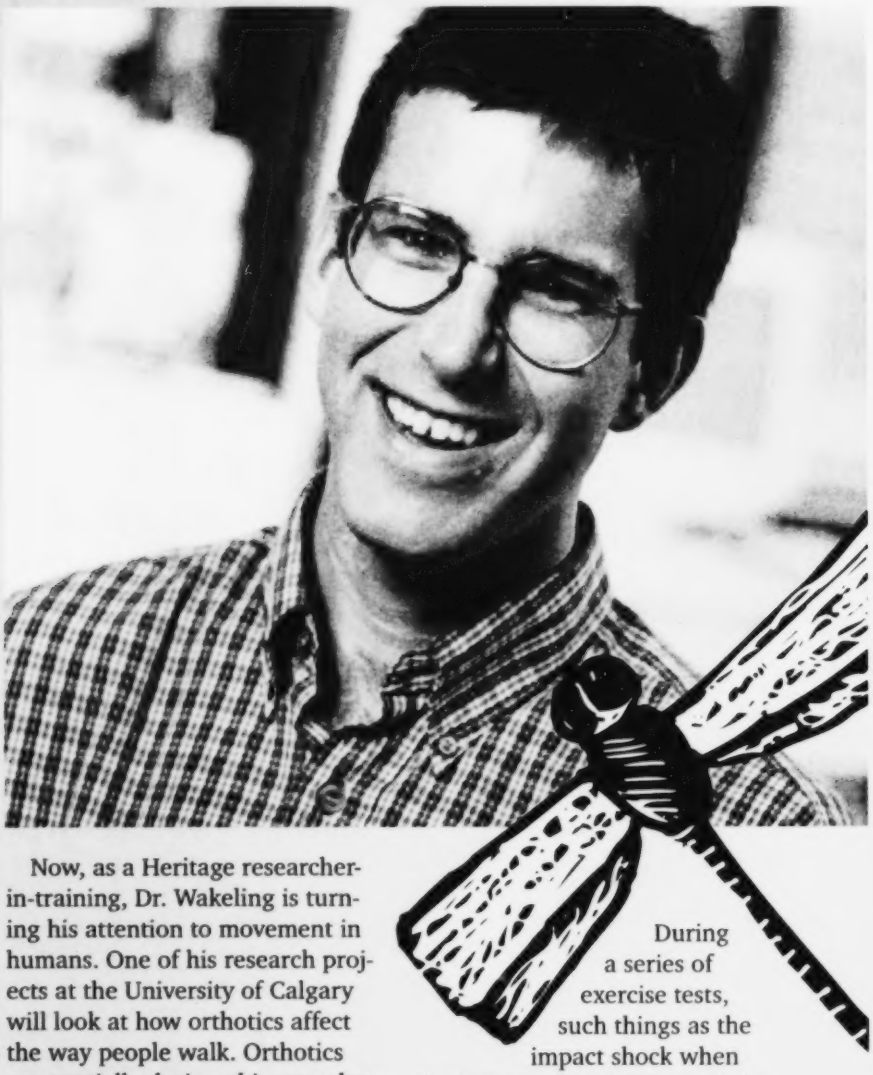
If the shoe fits, wear it



They can hover, and fly forward and backward at speeds as high as 30 kilometres per hour. No wonder it takes a sharp eye to follow the winged trail of the dragonfly. This speedy insect, which can change direction in mid-flight, is a stunning example of the beauty and complexity of movement.

Dr. James Wakeling has had a particular fascination with how living things move. His Ph.D. in Zoology from the University of Cambridge in the U.K. focused on the flight of the dragonfly. High-speed film allowed him to capture the insect's flight patterns in order to study how their bodies move and their muscles function.

These studies led Dr. Wakeling from movement in the air to movement in the water, where he focused his interest on the intricacies of muscle function in fish as they swam. Put simply, a series of muscles on each side of the body contract in succession to whip the tail back and forth and propel the fish forward.



Now, as a Heritage researcher-in-training, Dr. Wakeling is turning his attention to movement in humans. One of his research projects at the University of Calgary will look at how orthotics affect the way people walk. Orthotics are specially designed inserts that are worn inside the shoe to help correct such foot problems as flat feet or heel spurs.

In the lab, study participants test different types of shoes where the shape and cushioning of the sole have been modified. During a series of exercise tests, such things as the impact shock when the foot touches the ground, the resulting leg vibrations, and the muscle activity are measured.

The way muscles are used during walking and running changes with each new shoe you wear, Dr. Wakeling explains. "Although we know that orthotics do benefit

people, if you compare two different inserts the difference in their performance is very small," he says. "It's very hard to quantify exactly what the orthotics are doing and how they may be changing the way a person walks."

If scientists can understand more about how muscles work and how they compensate for injuries or other problems, the results could lead to better shoe designs for specific foot problems, Dr. Wakeling comments. Better shoe design will benefit not only high-performance athletes seeking an edge over their competitors.

"Wearing more comfortable shoes will help improve the quality of life of everyone from the 18-hole golfer to the elderly woman walking her dog," he notes.

Dr. James Wakeling is a Heritage Post-doctoral Fellow in the Faculty of Kinesiology at the University of Calgary.

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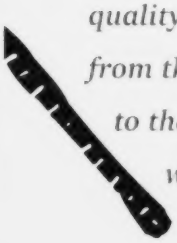

reader resources

Movement and exercise

To read in-depth stories on Dr. Yagesh Bhambhani's research project, go to http://www.ahfmr.ab.ca//frames3.html and select the AHFMR Newsletter Fall 1999 issue.

For more information on Dr. Tim Heslip's research, go to http://www.ahfmr.ab.ca//frames3.html and select the AHFMR Newsletter May/June 1999 issue.

To read about Dr. Kerry Courneya's work on exercise and cancer, read the AHFMR Newsletter March/April 1999 issue at http://www.ahfmr.ab.ca//frames3.html

If the shoe fits, wear it

Find out more about the types of foot pain most people experience on the WebMD site at http://webmd.lycos.com/content/dmk/dmk_article_5462095

Foot pain, wallet gain

Johns Hopkins Department of Orthopaedic Surgery www.med.jhu.edu/ortho/sports/plantar.htm

A new use for an old drug

The Heart and Stroke Foundation http://www.hsf.ca

What you don't know can hurt your newborn

Group B Strep Association http://www.groupbstrep.org

Shades of Grey

American Psychological Association http://www.apa.org/pubinfo/depress.html

National Institute of Mental Health (National Institutes of Health) http://pharminfo.com/disease/mental/depression/dep_women.html

Education•Wife Assault: Trauma http://www.womanabuseprevention.com/html/trauma__post-traumatic_stress_disorder_and_secondary_trauma.html

Looking through the "window of vulnerability"

Alberta Alcohol and Drug Abuse Commission http://www.gov.ab.ca/aadac/index.html

A World First in Diabetes Treatment

Canadian Diabetes Association http://www.diabetes.ca/

Alberta Foundation for Diabetes Research, http://www.afdr.ab.ca/

The Canadian Association of Transplantation http://www.transplant.ca/sld004.htm

Information about organ donation:

H.O.P.E. Calgary
Foothills Hospital
1404 - 29th Street NW
Calgary, Alberta T2N 2T9
Tel: 403-283-2243

H.O.P.E. Edmonton
8440 - 112th Street
Edmonton, Alberta T6G 2B7
Tel: 403-492-1970

Comprehensive Tissue Centre
3rd floor, Red Cross Building
8249 - 114 Street
Edmonton, Alberta T6G 2R8

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Heritage Youth Researcher Summer (HYRS) Program

On July 5, the Alberta Heritage Foundation for Medical Research launched a new program at the University of Alberta and the University of Calgary concurrently. The Heritage Youth Researcher Summer (HYRS) Program offers exceptional high-school students from all over Alberta hands-on research experience at a university campus, introducing them to the research world and the many exciting careers available in this field. HYRS was modelled in part on the Women in Scholarship, Engineering, Science, and Technology (WISEST) program at the University of Alberta.

The 30 students were selected from an application pool of 247 students for this first year of the HYRS Program. Adjudication was based on high marks (at least an 85% average in core maths and sciences to meet university lab requirements), reference letters from teachers and people in the community, and a personal essay.

During the six-week duration of the program, students will work on research projects in a variety of biomedical and health research fields including cardiology, neurology, cell biology, nursing research, and genetics.

Since Heritage researchers are among the best in the world, chances are students will be working on research areas that are not yet in high-school or university textbooks.

The HYRS Program offers a well-rounded view of the research world, including field trips, guest lecturers, preparing and hosting a poster session, weekly presentations, and a Teachers' Day, where the students' science teachers will be invited to join them for a full day on campus. When the program ends in August, HYRS students are obligated to make a presentation on their summer research experience to a science class in their high school.

"AHFMR has an international reputation for supporting excellence in biomedical and health research in the province. The HYRS Program lets us reach out to the researchers of tomorrow by giving young Albertans an experience of research today," says Dr. Matt Spence, President and CEO of AHFMR.

HYRS

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HYRS 2000 participant Benjamin Hui with Heritage researcher Dr. Sandy Davidge, Univeristy of Alberta

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